Notes

on the Modes of Operating in the M. & R. Office Refinery, Melting Rooms, &c. —

P. 4. The chief difference in our practice is, that the Register is supposed to represent the M. & R. and makes entries of weights before & after melting, and ~~dis-~~ ~~tributes~~ calculates the pr ct. loss in melting each deposit. The M. & R. ~~weekly~~ discusses the losses in weekly groupings of deposits.

The M & R. has otherwise nothing to do with the Deposits, and, on sound principles, should not have, until they are officially delivered to him, when he becomes responsible for the Bullion; except that he advises how to melt the deposits, when called on to do so. Mr. H. Cochran, the Receiving Clerk can state what the practice is, with deposits until they are passed into the M & R's hands.

The smaller deposits ~~are passed~~ being small in number & weight allowed to accumulate, usually, ~~for a~~ until the close of the month before they are transferred to the M & R. The large ~~dep~~ deposits are transferred to the M & R. as fast as received when he has ~~a~~ vault-room to receive them. It frequently

It frequently happens that with the present heavy silver receipts, for lack of Vault room by the M. & R., the large silver bars are weighed & debited to the M. & R. but put back into the Supt.dt's vault, to be taken out when required to melt for coinage, the chief object in this hasty weighing is ~~being to Receiving Deposits~~ close out an invoice of silver as soon as practicable, in order to make official returns of value to the party from whom any special lot may have been received.

Receiving Deposits

When Deposits or Purchases, or Transfers are passed by the Supt.dt. to the M. & R. they are usually passed in groups, the Receiving Clerk, the M. & R. or their delegates, and ~~or his Assistant~~, the Register, ~~and the M. & R. or Assist. M. & R.~~, each ~~one~~ noting the weight of each draft separately, & ~~one~~ after that, the Receiving ~~of them~~ clerk calling out the weight, to which the others respond affirmatively or negatively, as they agree or otherwise. Every weight so taken is entered in their several ~~a different~~ books by each of the three persons weighing, and after a series of weighings, the whole lists are compared by one reading aloud the noted weights. In the case of refined silver bars, ~~now so~~ now so profusely ~~extensively~~ ~~brought~~ supplied to this Mint, each bar of 800 oz. @ 1800 oz. is separately weighed, & the weight entered

entered into the books of the 3 weighers, as above.
When they have to be left in the Supt'dt's vault, as above stated, consecutive numbers are marked on each bar, by which they are entered in the M & R's book of weighings, as well as by the Nos stamped on the bars, & by the Deposit Nos of the Mint, thereby insuring identity.

The M. & R. gives to the Supt'dt. ~~the receiving clerk~~ a Receipt for the Gross weight of bullion received, usually for each Invoice by itself; and for the smaller deposits of the Month at the beginning of the ~~Month~~ next Month, as soon as their value is ascertained by Assay.

While the M. & R. receives the Bullion in grs, he is debited with its Standard Weight, calculated from the Gross weight & the Assay, by two Supt'dt's Clerks, separately, & by different methods. The M. & R. has not official force sufficient to calculate the Standard weights of Deposits, as they are received, and must perforce accept the calculations of those clerks as absolute truth.

Refining Gold

Our own Deposits of Gold are all refined by Acid, except those of merely melted coin, which are selected from the rest, to be melted alone. The other deposits varying as frequently

varying from 5 oz. to 1000 oz. each in weight, are assorted in lots according to each range of 100 ~~m~~ from 900 fineness down to 300, which last includes all deposits below 300. ~~No~~ This last lot ~~no~~ is worked alone, no silver being added to it, because it contains a sufficient quantity. To each of the other six lots, ~~from~~ 400 to 900, silver is added in such ~~proportion~~ quantities, that the proportion of silver (~~or other met~~ including copper, &c) is to gold as about 2 to 1. Each of these lots is melted, & granulated by being cast into cold water. ~~The~~ The granulations are boiled in pure nitric acid until nearly all the silver is extracted, & ~~then fin~~ further refined by hot sulphuric acid. The solutions of silver are entirely precipitated by common salt, and the resulting chloride of silver is reduced to metallic silver by granulated zinc. The reduced silver is washed, dried by a low red heat, & melted into silver bars of 998 @ 999 ½ fineness.

The fine gold from which all the silver ~~has~~ solutions been washed out, is dried at a low red heat, melted & cast into bars of 995 @ 999 fineness.

Refining Silver

Refining Silver

Good silver of 900 fineness is directly melted into Ingots for Coin; Fine silver, mixed with its due proportion of copper is similarly treated. All other silver, unless manifestly tough & adapted to coinage, is refined by acid. Such silver is cast into bars of about 200 oz. in the Deposit-melting Room, prior to their delivery to the M & R. These bars are boiled with pure nitric acid, the clear solution of silver racked off from the possible residue (& separately worked for often containing gold) precipitated by salt, & the washed chloride of silver reduced by granulated metallic zinc. The reduced ~~silver is~~ metallic silver is washed, dried, melted & cast into bars of 998 @ 999½ ~~fine~~, occasionally of 1000 fineness.

Making up Melts for ~~Gold~~ Ingots

In making up a melt for Ingots, whether gold or silver, about one half the amount of fine metal usually is taken, ~~because~~ of clippings from previous workings, received from the Coiner, making up the other half, because ~~since~~ experience shows that such clippings tend to ~~soften~~ improve the quality of newly-made alloys, & make it softer than if the whole

if the whole melt were made up of fine ~~metal and copper~~ silver with its due proportion of copper. Beside this advantage, clippings of standard metal ~~put into the~~ are charged into the ~~melted metal, from~~ ~~when it is nearly all melted~~ metal last of all in order to moderate the heat of the alloy, & reduce it to the temperature best adapted to casting, as determined ~~by~~ experience may

~~The bullion to be made into Standard metal is weighed by (who keeps an account of the weights) the Assistant Melter & Refiner, put into a copper-lined box.~~ The M & R., or the Assistant M & R., weighs out the due quantity of bullion for a melt to be made into standard, notes the weight (twice read, by himself & by the weigher,) ~~in the book kept~~ for the purpose, ~~called~~ "the Working Book", and puts in the bullion arranged into a copper-lined box. He then ~~carefully~~ calculates accurately the amount of ~~alloying~~ copper or of fine metal, as the case may be, required to bring each melt to standard fineness, weighs it out, and adds it to the melt, ~~A half dozen (more or less) of such melts are~~ several boxes containing that ~~so~~ weighed out consecutively ~~at a time~~.

(over) In this case also a double reading of the weight is ~~resorted to~~ practised to insure greater accuracy. The single calculation of the ~~plan~~ quantity of copper or of fine metal, required to make standard, seems to be quite sufficient, for we have not found an error in 1000 melts.

When a car

To facilitate ~~the~~ weighing out the precise amount of Copper, the best Copper Ingots ~~(at present we employ those of Pope, Cole & Co. of Baltimore)~~ of 12 @ 15 lbs. weight are cast by us into thinner ingots, some of which are ~~again cut~~ sheared into smaller pieces, ~~and some are cast into water~~ or shot and to make the finest granulations ~~of shot~~ some ingots are cast into cold water to make shot of various sizes & weights. (A special account is kept of copper used for alloying for gold & silver ~~is kept apart from that used in the base coinage~~.

~~fine gold, next added~~. Experience has shown that the affinity of copper and gold for each other is a ~~strong~~ one, and their alloy or but slowly to segregate into richer & poorer alloys; ~~in a short space of time~~, as I think from my experience, except through the presence of small quantities of ~~foreign~~, of some other metals ~~such as antimony, & its Subphide~~, which I think appear to increase the tendency to segregation, and except when in masses melted without stirring.

To facilitate stirring the melted metals, I contrived a black lead paddle of convenient form, with a few holes ~~thro at~~ near the lower end, whereby the liquid metals are devided into many streams, ~~and~~ whose increased surface of contact between the gold & copper insures a more rapid & thorough alloying ~~blending~~. Experience confirms the ~~excellence of them~~ efficiency of these stirrers

Powdered charcoal is continually kept on the surface of the metal during melting & casting; & to avoid loss by volatilization the draft of the furnace is ~~stopped~~ off, so that the fumes escape in ~~the~~ to the melting room & deposit their possible dust, ~~to~~ go into sweep. The ingots coming hot from the moulds, are dipped for a few minutes in water acidulated with sulphuric acid, whereby their surfaces are ~~the~~ made clean & bright & then washed & cooled in cold flowing water. After cutting off the ~~having had their~~ tops or pouring gates ~~cut off (for being topped)~~ of ~~the~~ ingots, & filing off the feathered edges of ~~the~~ their sides, each ingot of a melt is stamped with figures ~~numbers~~ representing the assay number of ~~the~~ that melt from the beginning of the year.

Pieces are chipped by the assayer from the first & last ingot of each melt, respectively marked 1 & 2 of that melt, (and the

and the result of their assay determines ~~the~~ whether they may be delivered to the Supt dt. as of the proper fineness for coinage. ~~As a general rule the fineness of our ingots~~ The minimum and maximum of fineness is rarely outside of ~~varies between~~ 899.9 ~~and~~ stet 900.1, and our practice is never to allow a greater variation than from 899.7 to 900.3. stet.

No 1 over

Making Silver Ingots

We usually ~~make up each~~ cast from ~~from~~ each melt of Standard ~~to~~ Silver ~~to 3000 @ 3300 oz.~~ about 3500 oz., which by topping & filing each ingot is reduced to 3000 @ 3300 oz. for the Dollar, ~~and or to 2700 oz~~ and rather less for the quarter-dollar.

over

The melts are made in No 70 Black Lead Pots, ~~in a similar~~ over No 2 manner to ~~have of the~~ The melts are treated similarly to those of Gold ~~melts~~, a part of the fine metal & all the copper ~~coins~~ being first charged & melted, before the rest of the fine metal, & last of all clippings being ~~last~~ added. A slight covering of borax, which facilitates the fusion, & protects in a measure against oxidation and volatilization, is skimmed off when the fusion is complete & the metal well stirred, ~~the borax is skimmed off, a result facilitated~~ melted & its total removal is more completely effected by the addition of a little fine charcoal, to which the remaining borax adheres, ~~which is well~~ skimmed off leaving a brilliant ~~surface~~ surface of metallic silver. The ~~It is~~ the clean immediately ~~the melted~~ metal is ~~then~~ covered with fine charcoal, (so that both are more easily & completely) which is continually added during casting, ~~and~~ so that in the atmosphere of carbonic oxide & acid volatilizing waste is measurably diminished, & the oxidation of both copper & silver prevented or ~~dimin~~ lessened although

(2) a loose black-lead ring being put on the top of the crucible (& the cover again on it) so that the usual commercial pigs of silver, being longer than the interior height of a pot, & projecting above it, are protected from the ~~act~~ injurious direct action of the fire. This virtual deepening of the crucible further allows full & free stirring with less danger of sparkling into the fire. A piece of ~~black~~ black lead ~~pot~~ is put at the bottom of the melting pot as a stool for the ~~large~~ large rectangular pig to stand on while melting, lest its ~~sharp~~ ~~angles~~ weight (100 lbs. more or less) should press the solid angles through the sides of the ~~cru~~ pot.

Alloying Silver with Copper to attain coin of 900 or

(1) The quantity of Copper required to bring silver to standard fineness is different from that for gold. First, because, when a silver ingot is cast, ~~the~~ normal segregation throws a richer alloy to the center of the ingot, from which ~~fact~~ the blanks are cut out; therefore the standard of ~~the metal~~ the ingot should be lower, so that the central part, may be the desired standard of 900 fineness. Second ~~further~~ because, in spite of all precautions, while melting, there is a tendency ~~in~~ in traces of copper to ~~volatilize~~ oxidize & burn off, & to that very limited extent to raise ~~alter~~ the standard, so that a shade more copper should be used to replace that which burns off. Third, because, in the act of cleaning blanks, to give them a pure silver surface, they are plunged while hot into dilute sulphuric acid, whereby copper is extracted from the surface, & to a depth depending on the strength of acid & time of immersion ~~time they are remain in the acid~~. I determined long ago from experience that in order to obtain silver coin of 900. we should not raise the metal above 898; but the more exact determinations by Prof. R.E. Rogers proved that we should add so much copper as to bring the metal no higher than 898 2/4 fineness. We have followed this standard ever since with the result of fairly averaging 900 in our silver coin.

Altho
~~While~~ The stirring of standard silver is much more easy than that of gold, because it has ~~nearly~~ only about one half its specific gravity, ~~so that & the~~ so that a thorough ~~un~~ blending of the metals into a homogeneous alloy is secured, yet the strong tendency of the standard silver alloy to segregate into richer & poorer alloys, both in the melting pot, & in the act of congealing, demands special and watchful care, when casting standard silver ingots.

Segregation & True Assay of Silver

Altho the general fact of segregation was known long since, & a law of distribution of poorer & richer silver-copper alloys ~~of copper~~ had been determined by the Assay Dept of this Mint, yet its importance & influence has been increasingly acknowledged up to this very year. ~~Some~~ not many years since ~~it was proved~~ stet that the method in use up to that time of clipping off a slip from the first & last ingot of a melt for assay did not ~~yield reliable results of the assay of the~~ give the true average fineness of the ~~coined~~ metal. The method was then adopted, which has ever since continued in use, of casting some of the metal into water (granulating) when beginning ~~to~~ & casting a melt, & just after thorough stirring, and again just before granulating finishing the casting of a melt. The uniformity in the assays returns of these two granulations may be presumed to determine the true fineness of all the intermediate metal. Even when this method is practised, the importance of thorough stirring was

word segregat

omit ?

was clearly shown ~~at the annual assay~~ in Feb. 1877, when the ~~first~~ & last granulations of melted coin, that had been stirred, but not enough, showed wide variations in ~~the assay~~ fineness, upon assay, ~~until by~~ but after remelting & thorough stirring, they nearly coincided.

therefore at perfect an average of 900 as practicable

~~Stirring Casting Silver Ing~~ Stirring Silver Ingot melts. The above illustrates the ~~im~~ vast importance of stirring Ingot melts immediately before casting. It is the more important ~~bec~~ at the present time, because most of the fine silver received from Refineries retains a small percentage (one or more thousandths) of base metal, lead, antimony, &c., which, in my view, tends still more strongly to induce the segregation of alloyed ~~opp~~ silver & copper into richer & poorer alloys, thereby ~~destroying~~ breaking up the legal standard. While casting a melt of standard silver, the stirring should ~~may~~ be continued, either ~~by~~ directly ~~thro~~ by a stirrer, or by an occasional dipping cup full of metal raised to a little height above the melting pot & poured into the latter, or lastly by ~~throwing~~ the dipping cup into the melted metal up & down, so as to mix the metal. The melted metal should be disturbed continually during ~~melting~~ casting to insure ~~that~~ the maintenance of the legal standard from the beginning to the end of the casting. Even

Even with the precaution of keeping the melted silver agitated to counteract segregation, we always leave a portion of silver (200 @ 300 oz.) in the melting pot for the next melt, because ~~in d~~ it would take too long a time to dip out the last remnants, which ~~would~~ might induce segregation, & which would certainly expose the silver to volatilization, because the relative mass of the fire is so much greater than the small metallic residuum, as to bring the latter to a volatilizing heat

~~When all the ingots of a melt have been cast~~

When cast, the silver ingots of a melt are treated similarly to the gold, dipped in dilute acid, topped, ~~filed~~ filed on their edges & dried, with ~~only~~ this difference that only the top layer ~~of ingots in~~ of ingots of the melt in a box are stamped with the number of the Melt.

over

Delivery of Ingots & Receipt of Clippings

The Supt. or Supt. acts ~~as the medium of~~ intermediately in transferring Ingots from the Melter & Refiner to the Coiner, & of Clippings from the latter to the former, all three officers or their delegates being present at and during each transfer. The Supt's ~~weigh~~ delegate weighs the bullion; each of the three deputies reads & puts down the weight; after which the weight is read aloud. Disagreement

Since an ingot of 898 3/4 ~~m~~ will make coin of 900, it is ~~our~~ the usual practice ~~not to~~ of the Assayer, not to certify to the legality of ingots ~~of~~ outside of 898 or 900; but ~~it is~~ [illegible] the standard of nearly all fluctuates between 898 1/2 and 899 1/4 ~~m~~.

Disagreement in weights is rectified by reweighing.

Gold melts of Ingots are weighed singly; but silver melts in masses of about 5000 oz. each. The entries in their respective books consist of the date of entry, the number of the melt (if gold), the number of the draft in weighing, the description of bullion (such as clippings, or number & denomination of ingots), and the weight. At the close of the transfer, the sum of ingots & ounces is noted by each delegate, & read aloud to clinch the accuracy of the whole transfer.

Summaries of deliveries are compared monthly or oftener.

Full receipts are given at the close of each delivery by the Supt'dt. to the M & R. for Ingots or Fine Bars, & by the M & R. to the Supt'dt. for clippings, & other Bullion (rarely other Bullion).

At the close of each day's work, the filings of the day (gathered, weighed, & filings the tops are weighed. These, and the tops of clippings, or other bullion, not cast into ingots, are the ingots, and the residue of the last melt cast into bar form,) are all separately weighed.

Daily record of melting Gold & Silver as against the Master melter by the M & R. & Records are kept of the amount of bullion sent to the melting room each morning & such as the above residues of the previous day's work, clippings & receipts from the Supt'dt., melts made up of fine metal & with their suitable alloy, and other bullion, all calculated and made up

made up to the Standard of 898 3/4 m. by copper or fine metal. The master melter is charged with all the above. At the close of the day, the master melter is credited with the then residues, as above noted, and afterwards with the weight of the Ingots (when delivered to the Supteat), any condemned melts, & with the grains of that day. ¶ The sweepings of the melting room floor, & the skimmed plags of each melt, are put into a cold melting pot & left to King in a good fire. The King is the next morning melted with the grains, & sifted out of its flux, into a bar called grain-bar of such a date, stamped with its consecutive N° from the beginning of the year, & credited to the master melter for the previous day's work. To make the Daily Melting Record more truthful & reliable all the deliveries to, & returns from, the Master Melter, as above, are calculated to the standard of 900 m, the Ingots, bars & tops, filings, & prepared melts, being assumed at 899, & the clippings at 898 m, all other lots being calculated from the fineness reported by the assayer. The balance between these debit & credit accounts show the losses of that day's work, with sufficient approximation to the truth, to ascertain whether they are at the usual rate, or are excessive. Deep & General Queries are Desirous of knowing this as soon as possible after the Melting, the bar of general grains & the sweep are excluded from the daily account.

At the close

filing benches

of the ~~stone~~ floor under the iron grated floor, near the ~~melting~~ furnaces &

~~of the floor under the iron~~ near lattices.

At the close of day's work, the sweepings ~~of the melting room floor~~, and the slags skimmed from all the melts of the day, are put into an old melting pot, & left to ~~king~~ in a good ~~fire~~. On the following morning the ~~slag~~ ~~on~~ slag on the ~~king~~ ~~melting~~ furnace & the worn out pots, & the ashes of the previous day, are ground & sifted in the sweep cellar, making coarse grains, & ~~fine matter~~ finer powder. This powder, when washed, yields fine grains & sweep. The king ~~metal~~ is melted with the coarse & fine grains into a bar, termed the grain-bar, ~~or shorter~~, "~~grains~~", which is stamped with ~~the~~ its consecutive number from the beginning of the year, and credited to the master-melter for the previous days work. The slag from the grains ~~goes~~ helps to form a bar of General Grains for the month.

~~The~~ former of which is ~~The fine grains are~~ gathered from ~~the hopper of~~ the washing machine on the second morning after melting & dried.

At the close of ~~the~~ a month all the daily grain-bars of the month are melted into one or more bars, called "Consolidated Grains", whose weight & assay confirm the standard weight of the sum of standard weights of the separate bars. The slags from melting the daily grain-bars, & crucibles & ~~melting pots~~ and the ~~old melting pots~~ are ground & sifted, & their grains, together with ~~of the month~~, the residues from ~~cleaning the~~ dipping ingots in ~~acidulated water~~ dilute sulphuric acid, and any other possible residues, are ~~gathered ground if necc~~ melted at the close of the month into one or more bars, termed General Grains. These always ~~exhibit~~ diminish materially ~~Sweep~~ the apparent daily losses, which are further reduced by the sweep & amalgam.

Sweep.

The residues, above noted as finally passing through sieves (up to N° 60) are passed through a washer & amalgamator. (from melting for gold & silver) in a dry state (suspended in a constant stream of water, fine matter of the water, after depositing its fine grains & part of the daily grains, as above) The ~~grains from the washer are taken as well the General grains~~ of the daily or general grains, the finer matter ~~is forced through~~ is forced under constant stirring through mercury, which takes up a ~~large~~ portion of gold & silver. The amalgam is ~~occasionally~~ pressed usually distilled, & the bullion once in a month, & its melted bar ~~numbered~~ assayed, numbered & named "Amalgam bar". The ~~sweep~~ fine matter which passes from the mercury is Sweep, suspended in water.

~~The amalgam is distilled once a month or occasionally, & yields a bar, termed amal which when melted, is assayed, numbered, & termed Amalgam bar.~~ being being moderate in quantity

in water, and flows into a settling tank, ~~consisting~~ of which is a wooden box, lined with sheet lead, & divided into 3 compartments by ~~diaphragms~~ partitions of sheet lead. The stream first entering one compartment, flows into the next one through an open slit in the middle of the ~~diaphragm~~ partition, through a similar slit into the ~~A B C~~ third, ~~and lastly~~ then over the top of the box, ~~&c~~ which at that point is a little lower, into another settling tank below the ~~top~~ upper one, ~~when~~ from which it is drawn off clear from sediment. & lastly into deep wells. ~~The gr~~ By far the ~~greater~~ larger & most valuable part of the sweep settles in the 1st compartment of the upper vat, from which a barrel of sweep is often collected daily; while ~~The~~ lower vat & wells are not required to be cleaned oftener than once in the year.

There ~~are two~~ is a pair such upper vats, so arranged, that while one is ~~being~~ emptying, the other is filling. ~~The sweep~~

~~The dried sweep is arranged in lots of ten barrels~~

The dried sweep sufficient for a barrel is first ~~mixed~~ mingled by shovel on a stone floor, ~~then~~ again mixed by shoveling more thoroughly ~~mixed by~~ blended by into a large box, then sifting from this ~~box~~ into another similar box, & lastly once more mixed by transferring it to a barrel. The sweep, thus ~~reduced~~ dried to a powder by grinding, sifting, & washing, ~~to grains~~ to dust of uniform size, ~~thus repeated mixing~~ becomes, by this repeated handling, ~~mixing~~ as perfectly commingled, as it is possible to make a mechanical mixture; but in order to obtain, ~~a perfect~~ if possible, a still more perfect average for assay, each barrel of sweep is pierced through its whole depth ~~is sampled~~ by a hollow steel cylinder

cylinder, (like those used for flour barrels), ~~made for the purpose~~, ~~of the full length of a barrel~~, ~~& do~~ which is drawn out full of sweep, representing every inch in depth. Our practice is to sample ten barrels of sweep for assay, each barrel having been prepared & drawn in the manner just described, ~~each barr~~ The ten samples are repeatedly mingled by averaged ~~by~~ ~~reading~~ & sifting; and the averaged assayed for gold & silver. Have I cannot imagine a more perfect system of averaging sweep than this, which I introduced many years since. The assays of sweep are made as soon as each lot of ten barrels is filled. The barrels are headed up and weighed, as soon as sampled.

Special Accounts.

Daily Mellings. ~~The account of daily mellings~~ This account has been already described in detail.

(over)

Refining. ~~Deposits on account of the small amount of our own deposits~~ this Mints deposits for Refining, our practice is to take ~~the~~ Gold ~~the smaller and the smaller~~ Silver once or twice in the month. The gold deposits are arranged in 7 ~~lots~~ series, (one or more boxes to each series) according to their hundredths of ~~dozen~~ fineness, from .300 to .900, ~~those~~ below .400 in ~~the~~ one lot, called the .300 series, ~~the~~ (or 3rd box), ~~those below~~ from .400 to .499 in the 4th box; &c, &c, ~~those~~ the deposits derived from good Coin being reserved for melting only. So much gold of each box is taken as will make 2400 oz., or a melt for granulation, when calculated the quantity of silver is added to it, to make the ratio

Refining Account

The large Gold & Silver deposits are taken by the M. & R. in quantities by themselves, the small ones every day as soon as practicable after their assay & the calculation of their value from weight & assay ascertained. A receipt is on each occasion given for the gross weight received & they are separated into those of standard fineness from melting coin, & to be simply melted again into standard Ingots for coin; — 2. into fine bars, to receive their due proportion of copper alloy & to be made directly into coin-ingots; — and 3. into those requiring to be refined by acids. If either hard or brittle, they are toughened by fluxing in the melting Pot. If any lots of Nos 1 or 2 be

The two former classes are embraced in the Account of Daily Workings; the last in the Refining Account.

The gold deposits are calculated, & so much silver (whether base or fine, is not essential) added, that the ratio between pure gold & silver (including base metal), shall be about 1 : 2

The usual melt of 2400 oz. therefore consists of about 800 oz. of pure gold, & 1600 oz. of silver, &c. After melting & thorough stirring, the alloy is dipped out & cast from the height of several feet by a gyratory motion into very cold water, the object of such granulation being to present as large a surface as possible to the subsequent action of nitric acid, of 35° @ 40° Beaumée. The granulations are steamed in contained in 20 gal. porcelain pots, & pure nitric acid of 35° @ 40° Beaumee being economically added as part of the charge. From the undissolved residue of tolerably fine gold, which is washed with water, & the silver recovered from the nitrate solution by common salt

over

~~between gold & silver, 1 : 2 (approximately). Of course~~ the silver deposits ~~containing~~ gold are employed instead ~~of silver alone, as far as practicable.~~

a debit ~~account~~ against the Refinery.
~~An exact~~ account is kept of all the gold and silver sent into it each ~~lot~~ lot or bar, however small, being entered separately ~~used for refining, reduced to standard weight,~~. After in gross weight, fineness, & standard weight.
~~the refining is completed, all the refined~~ in The Refinery is credited with all gold & silver, refined & melted, & calculated to Standard which it returns to the Vault, in the form of bars, grains, &c.; and a balance is struck between the two sides. As a general rule the loss is very small; where it is larger, it is minutely investigated ~~to deter~~ until the cause ~~or real~~ of the apparent or real loss is ascertained.

Vault Account

An special account is kept, in which the Vault is debited with all the bullion, put into ~~the vault is chd~~ deb it and credited with all taken out, the gold & silver being kept in separate accounts. The different objects ~~of the account~~ are classed together according to their nature, such as fine ~~silver~~ bullion, clippings, grain bars, deposits, &c. each of which constitutes an account by itself, & additions are made to it, or figures cancelled, as the case may be. ~~Where custom frequent changes are going on, we cannot at any moment~~ The accounts

by common salt solution, as chloride, which is reduced to metallic silver by granulated zinc, thorough washing, pressing dry, & melting.

The gold residue is treated by hot sulphuric acid in iron pans ~~at~~ by two successive charges, so that when the acids is poured off, & the gold washed, pressed & melted, it exhibits a fineness of 998@999

Pressing and Drying reduced gold & silver is resorted to save loss, ~~by mechanical dusting in the fire~~, for if the ~~raw~~ refined & powdered metal be put into the melting pot without pressing & drying, it boils in it, often violently, from the escape of steam, & the fine particles are carried into the chimney, with the vapor, & some of them escaping out of the top. The reduced metal, after ~~washing by litmus paper &~~ ample drainage, is pressed into cheeses, which in silver weigh about 40 lbs. each, by a powerful hydraulic press; and these solid cakes are dried on iron pans at a low red heat. When the broken cakes are now melted in the pot, not the slightest ebullition is perceptible, & the refining accounts show that ~~there is no appreciable~~ loss is quite incosiderable.

Instead of granulating we sometimes melt the gold with ~~in the ratio of 1~~ silver in the ratio of ~~1 : 1.3~~ 1 : 2½, cast them into 12@15 lb. bars, ~~which~~ and treat them in like manner with ~~oil of vitriol~~ nitric acid & oil of vitriol.

The accounts are always left open, because of the frequent daily changes in the contents of the Vault, but it would require only a few minutes' time to ~~tell the and~~ determine the whole amount in the vault. For the same reason of constant changes, the account is only kept in gross, & not calculated to standard weights, but as the finenesses are either entered in the account, or easily obtainable from other ~~accounts~~ sources, ~~a short~~ the whole could be reduced to standard weights in a short time. ~~The manner~~ To Each bar, ~~or~~ melt, or lot, ~~is entered by set down or put down~~ entered in the Vault book is set down ~~the~~ date of entry, ~~the~~ number of bar, &c., ~~the~~ description, gross weight, fineness in gold and silver, and date of removal.